

Norwegian Centre for Telemedicine

Improvement of Obstetric Care in Malawi

ICT and Telemedicine Recommendations

Jan-Hugo Olsen, Kirsten Eriksen
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Preface

Our assignment has been to examine the possibilities of introducing different levels of ICT and e-learning to improve obstetric care in Malawi. This report describes our assignment and our recommendations for activities that need to be implemented in order to achieve our goals.

Our first meeting with Malawi and the people there made a deep impression. To introduce advanced technology in a poor country where an average day for many is about the fight for the basic needs seemed almost absurd. A couple of days went by before we began to see possibilities and realize that our commitment could make a difference.

We met a health care system that suffers from an acute shortage of health personnel. We met a health care system suffering from the lack of organization in the hospitals, the lack of reliable patient registration systems and the lack of patient follow-up. At the same time, we met dedicated health care personnel who really wanted to contribute, but because of organizational challenges and lack of money often felt that their contribution was not enough and did not give them the feeling of doing an adequate job. The situation for many of the qualified personnel is that they work too many hours for too little pay, and one of the consequences is that important health personnel are moving to better paid private or public work or they are leaving the country.

In our opinion, there is a potential to achieve the goals of making public hospitals attractive working places for health personnel in the future. We believe that the correct use of ICT, among other activities, will be an important incentive.

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Summary

The activities outlined in this document summarize our recommendations for the next two years. The recommendations are partly preliminary and final conclusions will depend upon the costs and further investigation. We feel the need to describe a two-year horizon for these activities. This timeframe is recommended because of the suggested two-year development period of the Electronic Data System for patient registration. In addition, experience from similar projects implemented both in Norway and abroad shows that a two-year timeframe is the absolute minimum needed to ensure successful implementation of the different ICT activities. It is of special importance to have sufficient time after the actual installation to ensure that the installed infrastructure and hardware are put into proper operation and receive the necessary local attention.

The recommendations for the implementation of the terms of work are based on our impressions from our visit in Lilongwe from November 21 to November 30, 2008. In addition to meetings held with hospital staff at Bwaila and KCH we also had meetings with:

- Baylor College represented by Mr. Thomas Taimu, Information Technology Manager
- UNC Project (University of North Carolina) represented by Mr. Samuel Kamanga, ICT Manager
- Baobab Health represented by Ms. Sabine Joukes, Director and Mr. Alex Gondwe, ICT Manager

During our stay we had continuous discussions with Mr. Anthony Muyepa, Head of ICT at the Malawi College of Medicine in Blantyre. Mr. Muyepa also joined us for two days in Lilongwe.

The purposes of the meetings with Baylor, UNC and Baobab were to learn about their activities and especially how they had solved their technical needs. These meetings provided very valuable input to our further discussions. One of the major issues uncovered was that these organizations are addressing almost the same target groups and carrying out very similar activities. This is especially true within the educational area. We feel that the possibilities for cooperating should be investigated further, and we therefore recommend arranging workshops as soon as possible to discuss these matters. All parties, especially the target hospitals, will benefit from coordinated approaches within the technical and other areas assuring the implementation of long-term sustainable solutions.

Unfortunately the new maternity wings being built at the two hospitals are not equipped with any form of ICT infrastructure. A good internal infrastructure will be the basis for an operating Local Area Network (LAN) and this is in turn a prerequisite for all activities related to electronic communications between the hospitals, electronic patient administration, access to e-learning material and general Internet access. We therefore recommend installing the necessary infrastructure for this as outlined in Appendix I.

One important issue mentioned during our meetings with the hospital staff was the lack of possibilities to hold regular staff meetings. The staff at the two hospitals are organized under the same administrative unit, and as such regular administrative follow-up is important. This is not possible because of the difficulties of travelling between the two hospitals. We therefore recommend installing video conference units at each hospital to help overcome these problems. These units can not only be used for administrative purposes, but also have potential for clinical use. The video units will be mounted on a wheel-based mobile rack and can easily be transported from the meeting room to, for instance, ultrasound offices. The communication between the hospitals will

be of very high quality because it is independent of Internet access and the availability of high local bandwidth.

At the moment there is no form of system for electronic patient registration and follow-up. This means that all patient journals are paper based, increasing the risk for information loss and errors in patient treatment. Though not a part of our tasks, we strongly believe that an electronic patient system will help to solve some of these risk factors, and we had discussions with Baobab Health around this matter. Against this background we are convinced that Baobab could offer a good, simple and sustainable solution for this. Baobab has long experience in developing and implementing electronic patient registration and administration systems. Baobab has had several meetings and discussions with Dr. Tarek Meguid at KCH to specify an electronic patient record layout. Based on this and their own experience in patient administration they have designed recommendations for an electronic system for the maternity wings at the two hospitals. This recommendation is described in Appendix II.

Space for International Health

In parallel with our engagement in the maternity project, we have been approached by the Norwegian Space Centre, NSC, and the European Space Agency, ESA. ESA has a programme called "Space for Health"¹ promoting the use of space to overcome some of the limitations in ICT infrastructure especially in countries in the third world. ESA has agreed to partly finance and cooperate with a Norwegian initiative based on the use of satellite communication technologies. The Norwegian initiative is called "Space for International Health" and has two main goals. The first is to provide solutions for training medical personnel in Africa using telemedicine educational programmes, and the second is to provide local/regional health authorities with updated malaria risk information on a regular basis.

The initiative has assembled a consortium consisting of Norwegian medical professionals, experts on telemedicine and e-learning programmes, meteorological expertise and development aid professionals, in addition to different kinds of space-industry and space-related communities. For this initiative it is essential that the services provided can be sustained and low-cost, since the targeted users are health care systems in Africa with limited resources. The technology and expertise needed to ensure the products and solutions are therefore mainly based on established products, but sometimes from a different context.

The initiative will consist of two main project phases. Phase one will be a feasibility study lasting nine months. The aim of this study is to investigate different solutions and provide a demonstrator. Phase two will last at least two years and will be a demonstrator and implementation phase.

The consortium is led by the Norwegian Centre for Telemedicine, NST, represented by Mr. Jan-Hugo Olsen. This means that NST will be responsible for all coordinating activities and project management, and will also act as the main contact point with regard to ESA. The initiative originates from the NSC, and they will assist on a consultative basis during the project period. NST will link the activities in this project as closely as possible to the maternity project, but will run the two projects separately. NST and the rest of the consortium look forward to cooperating with ESA and NSC, and feel confident that this initiative will contribute to the goals, providing sustainable and low-cost solutions for e-learning and malaria risk mapping, and will also contribute to sustainable and low-cost solutions for the maternity project.

¹ More information can be found here: <http://esa.int/health>

Terms of Work

In brief, the terms of work for NST were specified as follows:

- To establish a broadband connection to (Internet access) and between Bwaila and KCH
- To report on the possibilities of using telemedicine services to support the exchange and education of health personnel at the Bwaila/KCH
- To report on the possibilities of use of ICT and e-learning in the training programmes

The above objectives were investigated during a visit to Malawi from November 22 to November 30 2008. During the visit meetings were held with the Norwegian Embassy, the Ministry of Health, hospital staff, service providers, different NGOs and educational institutions, and project management responsible for the construction of the two new hospital wings. The terms of work are far too complicated and extensive to allow making any definite conclusions or recommendations in such a short time. Thus further investigation is required in many areas, but based on the output from the above-mentioned activities, a few preliminary views on further progress are presented below. Alternative solutions are discussed where appropriate, and a prioritized plan of action is provided.

Discussions

This chapter describes the findings made during the visit, and gives a short discussion of alternative solutions and future work. We have also included discussion around the implementation of an Electronic Data System for patient registration and administration.

Broadband connection

A broadband connection to and between Bwaila and Kamuzu hospitals should be established between the new maternity wings being built at the two hospitals. This broadband connection will focus on four areas:

- Internal infrastructure, Local Area Network (LAN), in the new buildings
- High-speed link between the two hospitals
- Internet access
- Computers and related electronic equipment

Solutions for all areas must be found in order to achieve the expected output from the services implemented.

Internal infrastructure

During the design and building of the new hospital wings, an internal ICT infrastructure has not been considered. A basic internal ICT infrastructure is a prerequisite to the implementation of telemedicine services. Together with local personnel, including the construction project manager, we have identified some of the departments and offices that could benefit from the ICT services. Some of these areas are:

- All nurse's stations in all wards – for patient registration and administration
- Reception areas – for patient registration and referral
- Conference rooms – for educational and administrative purposes
- Administration areas and doctor's offices

Because of the structure of the buildings and the use of concrete walls it is difficult to implement a wireless network. The suggested LAN solution will therefore be based on standard Cat 5 Ethernet cables and fibre optics where appropriate with separate switches in each department/ward.

Link between the hospitals

Currently there are a number of organizations which provide different types of services for the hospitals. Some of them use high speed radio links for their communication lines between Bwaila and KCH. The study shows that it may be possible to cooperate with these organizations in order to share existing equipment and bandwidth.

Baobab Health² has placed communication towers at the hospitals and uses high bandwidth radio links between them. Baobab has offered free access to their towers. The project will need to invest in radio dishes and equipment for transferring data from the link to the LAN at each site.

Internet access

The Nepad Broadband Infrastructure Network (NBIN), formerly the East African Submarine Cable System, consists of fibre optic cables along the East African Coast. Activities are taking place to connect Malawi to this system, with an estimated timeframe of 3 to 5 years. This means that the only possible Internet access for the coming years will be by satellite. This access can be provided by a local Internet Service Provider (ISP), or it can be rented directly from one of the companies responsible for satellite services, for instance Vizada.³ Both solutions have advantages and disadvantages. The required satellite bandwidth will depend on the telemedicine and e-learning applications to be implemented. As a minimum, we would however recommend 512Kbps download, preferably 1Mbps. Work is in progress to determine the most cost-effective solution for this.

The Malawi College of Medicine in Blantyre has already established a high-speed satellite connection through Vizada. This bandwidth and the costs are shared between several institutions. In addition a new fibre optics cable is being installed between Blantyre and Lilongwe. Part of the capacity on this cable is dedicated for use by hospitals and educational and research institutions. The installation of the cable is scheduled for completion in June this year.

Computers and other electronic equipment

The enclosed offer from Baobab suggests the number of workstations needed for the Electronic Data System. In addition there will be a need for ordinary PCs and printers for both clinical and administrative purposes.

The overview of Ethernet outlets outlined in Appendix I contains recommendations for the installation of the computers. The minimum installation should consist of computers in the conference rooms, libraries and administrative offices. The implementation of this equipment should be performed independently from the implementation of the Baobab Electronic Data System.

Telemedicine Services

It is important to start with telemedicine applications that can be kept simple and efficient. There are a few applications areas that should be addressed on a short-term basis. These are:

- Email access for medical staff

² The Baobab Health Partnership is a Malawi-based NGO dedicated to the development of low-cost technology for developing countries. More information can be found here: <http://www.baobabhealth.org/>

³ Vizada is a France Telecom/Telenor offshoot, and operates the Inmarsat satellite services. More information can be found here: <http://www.vizada.com/>

- Internet access to medical information
- Access to e-learning material
- Video conference

Once the infrastructure, both internal and external, is in place, the distance between the use of ordinary email and more advanced use is very short. One of the doctors at KCH already uses his email system to send digital images of ECG diagrams to colleagues for a second opinion. All that is needed is a digital camera. This is an excellent example of a simple and effective telemedicine application. Ways of using electronic services tend to emerge by themselves as soon as the users become more familiar with the equipment and discover more possibilities. Other examples can be using email to send digital X-ray images for a second opinion. The images can be scanned from X-ray films using a high-quality scanner.

During discussions with local health personnel it became clear that having the possibility to communicate with colleagues electronically is highly valued. The same is true for using the Internet to retrieve relevant medical information. These two areas should have the main focus during an implementation phase. After this implementation, access to and use of available e-learning material will follow naturally.

We also recommend establishing an Internet access solution that is suitable for video transmissions. Plans need to be established for the use of these systems.

Implementing the above mentioned telemedicine services can be the basis of a long-term strategy. The years to come will offer new possibilities and these basic implementations can form the foundation for securing future progress and success. Health personnel have made it clear that Internet and email access are areas that will work as incentives for them and contribute to more interesting and meaningful work.

Electronic Data System for Patient Registration and Administration

In addition to the previously mentioned services, we recommend looking into the possibility of implementing a patient registration and administration system. Dr. Tarek Meguid at KCH has already started some work in this area, designing electronic patient forms. We feel that this is an area of great importance, but also an area where things can easily go wrong. Baobab Health has developed a unique concept for this purpose. Though specially designed to be used in the HIV/AIDS treatment units at the KCH Lighthouse and the Martin Preuss centre at Bwila, the system can easily be adapted to other needs. Work should be started as soon as possible with the aim of developing a simple and low-cost solution. In cooperation with Baobab personnel, selected personnel at the two hospitals should define what information will be needed for a suitable electronic patient journal at the maternity units, keeping in mind simplicity and ease of use. Work stations can be placed in the reception areas, the nurse's stations and relevant offices for this purpose. Such a system could also be designed for expansion to the district health centres, for instance by using mobile telephone technology.

ICT and e-learning in the training programmes

The two hospitals, KCH and Bwila, are both undergoing a complete reorganizing process. Construction of the new maternity wings is largely on schedule and they are expected to be ready by March this year. When the KCH wings opens, the staff from Bwila will be moved to KCH. Bwila will then need a full replacement of staff in order to run the hospital from the same point in time. Recruiting new staff will mainly be done from the districts and the district health centres. We are not involved in this process, but we would like to express our concerns and underline that this process may create some challenges in recruiting and stabilizing the staff situation at Bwila. The process

may also have implications for successful implementation of the different telemedicine services including the use of e-learning and other ICT-based training programmes.

E-learning focus areas

The general view is that both hospitals lack many types of health professionals, but midwifery is pointed out as the most critical profession. Our focus will therefore be on how to provide e-learning programmes and solutions for this group.

Different programmes are used in the education of midwives in Malawi, and some of them are not comparable to the Norwegian training and educational system. This is especially true for the enrolled nurses, who have a two-year education, and the Nurse Midwife Technicians, who have a three-year education. It is through these programmes that most midwives are educated and the focus should therefore be here. One challenge for the governmental hospitals is that many of these nurses are recruited to private hospitals and unfortunately also to different NGOs. One possible method of preventing this is to provide selected telemedicine services and electronic access to educational content, making this available for the staff during their normal working hours.

Because of the difference in educational programmes it may not be possible to directly reuse content from existing e-learning programmes used in Norway or other countries. It is therefore important to further analyse the needs in this connection. Such an analysis should be performed during the proposed workshop.

Recommendations

Internet access

The Malawi College of Medicine already has a satellite link installed. The satellite dish is physically located at the campus in Blantyre. From Blantyre to Lilongwe the data will be sent through a high capacity fibre optic cable installed by a commercial company. Part of this capacity is available for use by hospitals as well as educational and research institutions. We recommend a further investigation into the possibility of cooperating with the College of Medicine in this matter. This fibre optic cable is planned to be operational in June 2009. Details that will have to be discussed are:

- Bandwidth splitting
- Security issues
- Physical implementations
- Costs and responsibilities
- Time frames for installation

In parallel, detailed discussions with one or more ISPs should be carried out. The purpose of this is to find out if it is possible to agree on special rates and bandwidth guarantees.

Internal hospital infrastructure

Appendix I contains an overview of the proposed LAN access points at both Bwaila and KCH. The number of access points does not correspond directly to the number of computers recommended for the initial implementation. This is because some of the access points are reserved for the Baobab work stations and extra access points will give the hospitals the flexibility for further expansion.

In addition preparations should be made to configure one room in each wing as a server room. These rooms will have to be equipped with extra cooling units. Potential rooms have already been identified.

Link between the two hospitals

Baobab Health has installed radio towers in the vicinity of the two hospital wings operating their own wireless links. Baobab has a positive interest in cooperating with the maternity project, and has offered the use of this equipment at no extra cost. We will recommend using the radio towers and investing in two new radio dishes for this purpose. This will provide a simpler and more secure solution for the project, eliminating the need for bandwidth splitting and dealing with unnecessary data security issues.

Negotiations should be conducted with local partners regarding local support and service agreements.

Telemedicine Services

Initial focus should be on establishing the following services:

- Email access for medical staff
- Internet access
- Access to e-learning material
- Video conference

Email access

Email accounts should be established for all personnel. This can be done either through one of the free mail services, like Google mail, or by registering a separate domain for the hospitals. Most of the local Internet Service Providers also offer administration of email accounts. A separate email account for each staff member is a prerequisite for the use of most telemedicine services including e-learning.

Internet access

The access to electronic medical information through the Internet is one service that has been emphasized as important and much needed by the health personnel. Some of this information is collected by WHO through the HINARI program, <http://www.who.int/hinari/en>. This initiative provides free or very low-cost online access to the major journals in biomedical and related social sciences for local, non-profit institutions in developing countries. All this information and other relevant medical information will be available through ordinary Internet access.

Access to e-learning material

Some of the e-learning materials available consist of a combination of text, graphical animations, and maybe also short video clips. To access this material may require more Internet bandwidth than accessing email or text only information. To overcome the possible bandwidth restrictions, we recommend establishing a local content server for this purpose. Relevant e-learning content can be downloaded during off-peak hours, and will be accessible locally at all times at high speed. The server can be managed by one of the local partners, for instance the College of Medicine in Blantyre. The e-learning material currently available through the Norwegian Centre for Telemedicine is based on Open Source technology. This means that it is free of charge and can be used anywhere by anybody.

Video conferences

The use of video conferencing has in many ways become synonymous with telemedicine. Implementation of this type of service should also be considered. If the implemented Internet bandwidth is a minimum of 512Kbps it will be possible to achieve acceptable quality for video transmissions as well. The implementation of video conferencing creates many new possibilities ranging from education and administrative functions to remote guidance and diagnostics, for instance by connecting ultrasound equipment.

The staffs at the two hospitals belong to the same organizational unit. To obtain a high level of mutual connection between the two hospitals and secure the best levels of patient treatment, regular staff meetings are required. The current situation does not allow for this because of the difficulties of transporting personnel between the hospitals. Installing video conferencing will help to overcome these difficulties, making it possible to have staff meetings on a regular basis without moving personnel. Installing the radio link between the hospitals will secure a high-quality bandwidth for the video transmission, and because these transmissions only take place locally they will not affect or impose any restraints on normal Internet traffic.

The video conference units should be placed in the meeting/conference rooms. This will ensure easier access for most purposes, especially daily staff meetings. The mobile racks can easily be moved to patient areas.

We recommended appointing at least one person at each hospital as a local video conference "super user". This person will receive extra training and will be responsible for taking care of the equipment and assisting other personnel in the day-to-day use. This person should receive extra allowances for this work.

Electronic Patient Registration

Currently there is no reliable system for person identification in Malawi such as a social security number. The system developed by Baobab Health, though designed to be used in the registration and administration of the treatment of HIV/AIDS patients, can overcome some of these restraints. At the first hospital visit patients are identified by their name, age and address. A barcode is generated and this barcode accompanies the patient through the different hospital departments. The next time the patient goes to the hospital the barcode is scanned and all stored information is immediately available. Registration of patient data is done using touch screens through a simple and intuitive user interface. The equipment used is specially designed and dedicated to this purpose. This means that it can only be used for this application and has no value elsewhere. Special low-cost systems for continuous power supply and for generating power in areas where electricity is not available have been developed. The software used is based on Open Source technology⁴ and can easily be adapted to the needs defined by the maternity units at Bwaila and KCH. Baobab has also developed techniques for the transmission of aggregated data to the Ministry of Health. Activities connected with defining and implementing electronic patient records are:

- Define electronic patient record content and layout
- Define touch screen user interface
- Specify aggregated data for reporting
- Specify in-house areas for placing registration units
- Develop plans for training and follow-up

⁴ The system is based on OpenMRS, an open source electronic medical record system framework. More information can be found here: <http://openmrs.org/wiki/OpenMRS>

Appendix II is an overview of the suggested activities and budgets provided by Baobab for this purpose. The design is based on Baobab's own experience and on valuable input from Dr. Tarek Meguid at KCH.

ICT and e-learning in the training programmes

Activities connected with defining and developing e-learning programmes will include:

- Clarifying existing competence levels
- Defining goals and potential areas for further education
- Defining partners for content development
- Defining educational content
- Adapting content to an electronic format

At this stage it is not possible to prepare the exact figures for an e-learning budget. This can only be done based on the output from the proposed workshop. This is because the complexity, amount of work and technical challenges will depend among other things on content presentation and the educational methods implemented.

Clarifying existing competence levels

This work must be carried out by the maternity project and local health personnel in cooperation. It is especially important that local superintendent midwives, local doctors and Norwegian midwives participate in this project. Other important partners may be representatives from the Ministry and the local educational system including nursing colleges. This clarification will create the basis for further work within this area.

Defining goals and potential areas for further education

In order to provide educational content best adapted for local use, the actual goals for this education need to be defined. These goals must be defined within all potential areas, and will ease further work of defining educational content.

Defining partners and educational content

To obtain the latest and most up-to-date medical educational material, it is natural to seek assistance within the Norwegian educational system, in this case the three university hospitals that are involved in the project. Together they hold the best competence available in Norway. Possible cooperation with Norwegian Church Aid should be investigated. They are cooperating with CHAM, the Christian Health Association of Malawi providing educational programmes for nurses in the country.⁵

An important factor will also be to adapt this content to local needs and culture. This can best be done by including local expertise as much as possible. During the development of educational content it is important to keep the final outcome in mind. Experience shows that Internet-based education works best when the different courses have a modular structure offering a manageable size and duration for each module.

⁵ More information about CHAM and their programmes can be found here:
<http://coldfusionwebhostings.be/ICCO/www/index.cfm>

Adapting content to an electronic format

NST has long experience in implementing educational material for use over different electronic media. The content will be designed and edited in a form suitable for transmitting and reading over the Internet. NST recommends using the same type of e-learning platform for this as the one used in Norway through <http://www.helsekompetanse.no>. This platform is based on Open Source technology⁶ and can easily be adapted to local needs. The final design of the course modules will define the needs for technical infrastructure and placement of content servers.

Arranging workshops

The enclosed Prioritized Activity Plan summarizes the activities to be carried out in the next two years. Because of the number of similar activities and existing work targeting the two hospitals and educational environments connected to the hospitals, we recommend arranging workshops to discuss these activities. It is important to assemble all potential partners within both the technical and the educational area. The hospitals do not have any local ICT resources, and the workshops will have a special focus on the possibilities of sharing local ICT resources. Each workshop will last for two days and they will be arranged back to back, because some of the personnel will attend both. The first workshop will work with the technical aspects and the second with e-learning and organizational issues.

Establishing good, long-term educational e-learning programmes is not an easy task. There should be a strong focus on the planning of e-learning topics, and the different pedagogical aspects should be evaluated. Furthermore, it is important to secure a local foundation for this education. This will help in including the e-learning programmes as a part of the ongoing educational process for the targeted health personnel. E-learning programmes are typically something the students go through as a part of a normal working schedule. It is therefore important to get the necessary understanding from an administrative and ministerial level. Representatives from these levels should therefore attend this workshop.

Suggested topics for the technical workshop:

- Alternatives for Internet Access
- Terrestrial Infrastructure – use of existing and new fibre optics
- Internal hospital infrastructure
- Link between the two hospitals
- Development of an electronic patient registration system
- Sharing of local ICT resources and support
- Defining costs and setting up budget and timetables
- Defining short- and long-term responsibilities

The following suggested partners should participate if possible:

- NST with technical specialist
- Malawi College of Medicine, Blantyre, with Mr. Anthony Muyepa
- Baylor College of Medicine, Lilongwe, with Mr. Thomas Taimu
- UNC Project, Lilongwe, with Mr. Samuel Kamanga
- Baobab Health with Mr. Alex G. Gondwe (tech) and Ms. Sabine Joukes (director)
- Representatives from the two hospitals

⁶ This system is based on an Open Source Learning and Content Management System, LCMS. More information can be found here: <http://www.atutor.ca/>

Suggested topics for the e-learning workshop:

- Possible cooperation within the different e-learning and training environments
- Defining educational areas
- Sharing of local ICT resources and support
- Defining costs and setting up budget and timetables
- Defining short- and long-term responsibilities

The following suggested partners should participate if possible:

- NST with e-learning specialist
- Malawi College of Medicine, Blantyre, with Mr. Anthony Muyepa
- Baylor College of Medicine, Lilongwe
- Malawi Nursing College
- Representatives from the two hospitals:
 - Gynaecologist
 - Local superintendent midwives
 - Norwegian midwife
- Other Norwegian health specialists
- District Health Officer and other administrative hospital staff
- Representatives from CHAM and/or Norwegian Church Aid

The output of these workshops will be used as input to future work regarding detailed planning of the implementation of this project. The workshop will also contribute to the main input to the planning of the design and implementation of the e-learning programmes, including suggested budgets.

Activity plan and budget

The enclosed Prioritized Activity Plan summarizes the activities to be carried out in the next two years. All activities related to infrastructure, installing hardware and training, should be initiated and preferably performed during this year. Most of the activities can be executed in parallel.

Comments to the proposed budget

The prices quoted in the budget for computers and other hardware reflect the current price level in Norway. Investigations so far indicate that local prices are very high. Many Malawi-based institutions buy their electronic equipment abroad. All taxes can be deducted in the country where the equipment is bought. In Malawi there is no import tax, only 16 % VAT. It is still possible and advisable to sign service contracts with local partners.

Input 1 - Internet access

- Fibre Blantyre – Lilongwe
- Fibre to LAN interface
- Radio link between hospitals

Input 2 – Internal hospital infrastructure

- Building cable trunks and sockets
- Cabling and switches

The proposed recommendation for Ethernet outlets is described in Appendix I. The proposed solution takes future expansion into account and gives the hospitals flexibility in the construction of a long-term ICT environment. It is of course possible to implement a less flexible and less costly structure.

Input 3 – Computer equipment

- 6 computers and one printer at Bwaila
- 14 computers and 3 printers at KCH

This is a suggested starting configuration and is recommended in addition to the Baobab workstations.

Input 4 – Video conference equipment

- Two medium size “set-top” video conference units
- Two widescreen LCD monitors
- Two UNICOL type wheel-based mobile racks

Input 5 – Electronic Patient Registration

- Hardware installation
- Stage one and two software development and implementation
- Training

Details for this system can be found in Appendix II, “Maternity Ward Proposal for KCH and Bwaila, Installation of an Electronic Data System” from Baobab Health.

Input 6 – Administrative costs and human resources

- Administration, travel costs, room and board
- Two workshops, one technical and one e-learning
- Workshop reports and project documentation
- Overhead and administrative costs in Malawi and in Norway

Travel and accommodation is estimated for two trips for two persons for 2009 and two trips for 2010. This includes travel for attending the workshops.

Input 7 – e-learning and education programmes

- Define and write content
- Adapt content to Internet
- Develop and implement education programmes – local and distant

The costs will depend on the output and decisions made from the proposed workshop.

Input 8 – Running costs

- Monthly Internet fees
- Local support – computer equipment and video conference super user
- Overhead – spare parts

Activity Plan

Main activity	Detailed activities	Timeframe/ Duration	Responsibility
Establish Internet access	Bandwidth splitting Security issues Physical implementations Costs and responsibilities	May – 2 months	NST College of Medicine Other local partners
Internal hospital infrastructure	Nurse's stations in all wards 2 access points. Conference rooms 2 access points plus one wireless router. Reception areas 2 access points. Administration and doctors' offices The number of access points will depend on the number of desks. Consultation rooms	April – 3 m.	College of Medicine Proman Development ⁷ Building Contractors Local health personnel NST
Link between the two hospitals	Bandwidth splitting Calculations must be done regarding the needs for the different applications Security issues Baobab and Bwaila/KCH will use this bandwidth for different purposes. It is vital that the information is not mixed between the two organizations. Physical changes This includes the need for cabling or extra wireless link from the radio towers to the server rooms in the new maternity wings. Costs Responsibilities, both short and long term	April – 1 m.	College of Medicine Proman Development Building Contractors Local health personnel NST
Telemedicine services	Email access for medical staff Internet access Access to e-learning material Video conference	May – 2 m. May – 2 m. June – 2 years May – 2 m.	NST College of Medicine Other local partners

⁷ **Proman Developments** is a local company responsible for Project Management for the building of the new maternity wings. Managing director is Mr. David Wall. Email: dwall@malawi.net, tel: +265 1 770 805, Mobile: +265 882 3469

Main activity	Detailed activities	Timeframe/ Duration	Responsibility
Electronic patient registration	Defining electronic patient record content and layout Defining touch screen user interface Specify aggregated data for reporting Specify in-house areas for placing registration units Develop plans for training and follow-up	April – 2 y.	NST Local personnel Baobab Health College of Medicine
e-learning and training programs	Clarifying existing competence levels Defining goals and potential areas for further education Defining partners for content development Defining educational content Adapting content to an electronic format	June – 2 y.	NST HUH UUS UNN Local partners
Arranging Workshop	Combined Internet Access Terrestrial Infrastructure – use of existing fibre optics Internal hospital infrastructure Link between the two hospitals Possible cooperation within e-learning and training development Development of an electronic patient registration system Defining costs and setting up budget and timetables Defining short- and long-term responsibilities	May	NST College of Medicine

Budget

All amounts are in NOK.
One USD equals NOK 7.00

Item			2009	2010
Infrastructure and Equipment				
1. Internet access				
Fibre Blantyre – Lilongwe ⁸				
Fibre to LAN interface	USD 5 000		35 000	
Radio Link between hospitals				
Subtotal Internet costs			35 000	
2. Internal Infrastructure (See Appendix I)				
Bwaila	USD 28 000		196 000	
KCH	USD 38 000		266 000	
Cabling and routers	USD 15 000		105 000	
Subtotal infrastructure costs			567 000	
3. Computer Equipment				
Bwaila	6 computers	NOK 5 000 x 6	30 000	
	1 printer	NOK 1 500	1 500	
KCH	14 computers	NOK 5 000 x 14	70 000	
	3 printers	NOK 1 500 x 3	4 500	
e-learning Server			15 000	
Subtotal computer costs			121 000	
4. Telemedicine Services				
Video Conference				
Video Conference Unit x 2	NOK 45 000 x 2		90 000	
Monitor x 2	NOK 8 000 x 2		16 000	
Mobile Rack	NOK 10 000 x 2		20 000	
Subtotal video conference costs			126 000	
Total investment costs infrastructure and telemedicine services			849 000	
5. Electronic Data System (See Appendix II)				
Hardware costs each site	2009	2010		
Bwaila – Hardware	USD 39 215	USD 2 000	274 505	14 000
KCH Hardware	USD 50 540	USD 2 000	353 780	14 000
Subtotal hardware			628 285	28 000
Subtotal overheads	2009	2010		
	USD 39 220	USD 19 282	275 540	134 974
<ul style="list-style-type: none"> • 10% of current office running costs in year 1, and 5% for year 2 • 8% of HR (Country Director, administration) year 1 and 4% in year 2 • 10% support on capital expenditure for year 1, and 5% for year 2 				

⁸ Information given indicates that the owner offers fibre bandwidth for hospitals and research institutions for free. We have to make reservations to this matter.

Costs for both sites	2009	2010		
Operations & inst HW	USD 28 850		201 950	
Deployment & training	USD 11 444	USD 1 000	80 108	7 000
SW dev. & proj. coordination	USD 35 000	USD 35 000	245 000	245 000
On-going support	USD 9 840	USD 13 000	68 880	91 000
Labels/ribbons 1 year	USD 4 000	USD 4 000	28 000	28 000
Trainee allowances	USD 1 300	USD 300	9 100	2 100
Transport & fuel	USD 6 600	USD 3 000	46 200	21 000
Subtotal installation costs			679 238	394 100
Total costs Electronic Patient Registration			1 583 063	557 074
6. Administrative costs and human resources				
Norwegian personnel (400h x 550 – 150h x 550)			220 000	82 500
Local salaries			30 000	30 000
Workshop				
2 local workshops – spring 2009			60 000	
Approx. 20 persons				
Travel Costs and Administrative expenses				
Norwegian personnel			120 000	60 000
Local travel and transport			20 000	10 000
Subtotal Administrative Costs			430 000	182 500
7. e-learning and training programmes				
Defining & writing content				
Adapt content to Internet				
Training programmes – local & distant				
Subtotal e-learning & training programmes			To be determined after workshop.	
8. Running costs				
Satellite 512Kbps – USD 1 050/month			50 000	100 000
Local support			15 000	30 000
Overhead – spare parts			10 000	20 000
Subtotal Running Costs			75 000	150 000
Total project costs			2 937 063	889 574

Appendix I

Overview of recommended Ethernet outlets at the new Maternity wings at Bwaila and KCH

The tables below indicate the proposed ICT infrastructure as discussed with Mr. Anthony Muyepa and presented to Mr. David Wall, the construction project manager. The column Room Number refers to the room numbers used in the official building plans. Those checked off in the column marked "Pri" are the suggested minimum configuration and should all consist of Baobab Workstations (WS) - touch screens and necessary auxiliary equipment. Those not checked off are not priority one and the number and type of units to be installed depend on final funding.

Bwaila District Hospital

Room No	Dep./Room name	Outlets	Equipment	Pri	Comments
Outpatient & Administration – 24 Port Switch					
OW015	Storage		Server		Server Room?
OW028	Registration/Records	2	Baobab WS	√	
OW029	Nurse's Station	1	Baobab WS	√	This stations only one outlet
OW014	Conference Room	2	PC & Video Conf		Suggest wireless router for connecting additional PCs and laptops.
OW016/17	Clinical Offices	1 x 2	PC/Baobab WS		
OW010	Matron	1	PC		
OW009	Nurse's Office	1	PC/Baobab WS		
OW006	Ultrasound	2	PC/Baobab WS		May also need video conf.
OW004	Dispensary	1	Baobab WS	√	
Postnatal Ward – 8 Port Switch					
PW045/49	Nurse's Station	2 x 2	Baobab WS	√	For all Nurse's Stations we suggest two outlets. Number of WS at each station depending on funding.
Antenatal Ward - 8 Port Switch					
AW005	Nurse's Station	2	Baobab WS	√	
Labor Ward & Theatres – 8 Port Switch					
LT033	Nurse's Station	2	Baobab WS	√	
LT037/59	Nurse's Office	1 x 2	PC/Baobab WS		
LT047	Anesth. Office	1	PC/Baobab WS		
Nursery Ward – 8 Port Switch					
NW013	Office	2	PC/Baobab WS		
Gyn. Ward – 8 Port Switch					
GW006	Nurse's Station	2	Baobab WS	√	

Kamuzu Central Hospital

Room No	Dep./Room name	Outlets	Equipment	Pri	Comments
OBS/GYN – 8 Port Switch					
GW22	Nurse's Station	2	Baobab WS	√	
GW??	Second Nurse's St.	2	Baobab WS	√	
OPD Offices – 8 Port Switch (Admin building Ground Floor)					
GO1	Administration	1	PC/Baobab WS		
GO3	Reception	1	Baobab WS	√	
GO5	Nurse's Station	1	PC/Baobab WS	√	
GO15/16/19	Consultation Rooms	1 x 3	PC/Baobab WS		
Private Paying Ward - 4 Port Switch					
GP36	Nurse's Station	2	Baobab WS	√	
Labor Ward & Theatres – 8 Port Switch					
GT17/18	Nurse's Office	2 x 2	PC/Baobab WS		
GL20?	Nurse's Station	2	Baobab WS	√	
GH04	Laboratory & Office	1	PC/Baobab WS		
GH02	Nurse's Station	2	Baobab WS	√	
GH25	Sister's Office	1	PC/Baobab WS		
Nursery Wing – 8 Port Switch					
GN01	Meeting Room	1	PC		
GN05	Nurse's Station	2	Baobab WS	√	
GN07	Reception	1	Baobab WS	√	
GN26	Nurse's Station	2	Baobab WS	√	
Labor Ward – 12 Port Switch					
GH02/20	Nurse's Station	2 x 2	Baobab WS	√	
GH04	Laboratory	1	PC/Baobab WS		
GL22	Sister's Office	1	PC/Baobab WS		
GM14/17/18	Nurse's Offices	1 x 3	PC/Baobab WS		
Administration First Floor – 24 Port Switch					
GF23 or GF24					Server Room?
F01	Library	2	PC		
F03	Conference	2	PC		Floor box and wireless router?
F05	Registrar	1	PC		
F06	Admin	2	PC		
F016-19	Specialist Offices	1 x 4	PC		
F020	Clinician	4	PC		
F020-22	Matron	1 x 2	PC/Baobab WS		
F023	Student Room	4	PC		

Appendix II

Maternity Ward Proposal for KCH and Bwaila, Installation of a Electronic Data System

Background information about Baobab

The Challenge

Malawi, Africa has a population of 14 million. One million are HIV positive and there are just 280 doctors in the country. This tremendous disparity between healthcare workers and people in need of treatment contributes to high mortality rates particularly for women and children. Treatment protocols exist that do not require physician expertise. These protocols can ensure a minimum standard of care, but to be effective they must be rigorously followed and carefully monitored.

The Response

The core of Baobab's approach is the ***use of easy-to-use touch screen clinical workstations at the point of patient care***. This system efficiently and accurately guides low-skilled healthcare workers through the diagnosis and treatment of patients according to national protocols. The system also captures timely and accurate data that is used by healthcare workers during patient visits to supplement decision making. The data is aggregated and used at a national level for policy making and analysis. This technology-dependent approach has required both hardware and software innovations, including alternative power approaches, intuitive touch screen-based user interfaces for users with no computing experience, and low-cost information appliances that are significantly more robust in harsh environments than traditional computers.



Achievements to date

Over the past 8 years Baobab solutions have delivered the following:

- 1,000,000+ sessions for 18,000+ patients on antiretroviral HIV therapy across 6 sites
- 800,000+ patients registered across 5 sites
- 160,000+ HIV testing and counseling sessions across 5 sites
- 185,000+ x-ray/ultrasound investigations
- 40,000+ lab tests across 3 sites
- 100+ touch screens actively in use

About Baobab

Baobab Health Partnership was founded as a 501(c)3 non-profit registered in the United States in 2000. In 2008 Baobab Health Trust was established in Malawi to increase local ownership, oversight and governance via a Board of Trustees. From the beginning, the organization has dedicated its efforts to innovation and social justice through the use of technology in developing-world healthcare environments.

Short Term Goals

There are currently more than 32 HIV clinics in Malawi that are considered high burden sites, with more than 1000 patients receiving treatment. Installing the Baobab system at these sites will have the most impact, in terms of patient care and data quality. Hence these are the sites that Baobab is targeting for system deployment in the next 12-18 months.

Long Term Goals

Baobab would like to deploy a touch screen clinical workstation at every point of patient care in Malawi. By providing decision support and capturing reliable data across the healthcare delivery spectrum we hope to dramatically improve clinicians' abilities to care for their patients as well as improve the Ministry of Health's strategic use of information to monitor and plan for positive health outcomes.

Employees

Baobab consists of 30 full-time employees based in Malawi. The team includes a strong management team as well as excellent software developers, hardware and electronics specialists and even a team of welders. Baobab continues to grow at a rapid pace, with plans to grow by at least 30% during 2009. The strategic plan for 2009 focuses on the need to provide excellent support to all of our deployed systems while continuing to deliver innovative, relevant and robust software solutions. Hence field support, monitoring and evaluation staff as well as additional software developers are the top hiring priorities for 2009.

Philosophical approaches

- Simplify health care processes to help staff get their job done
- Hire and train Malawians to invest in indigenous capabilities
- Use open source principles and software to create and share best practice
- Engineer for harsh environments
- Build for redundancy to maximize system uptime and simplify maintenance
- Connectivity leads to productivity
- Long term support and service are critical success factors

The Proposal:

2. Both KCH and Bwaila maternity wards are currently being built and they will cater for 12,000 births per year divided over both wards. KCH will be slightly larger than Bwaila, as specialized cases would be referred to KCH from Bwaila for treatment and care. As both maternity wards would highly benefit from better record keeping, the proposal is to install an basic EDS system, which can be upgraded with additional software/data capturing modules as time goes on.
3. To enable the system to be in place as soon as possible (soon after the opening - depending on funding), we suggest to implement the software in stages. This can be done over a period of 2 years. The Modules we are proposing are as follows:

STAGE I (first 6 months)

- patient registration
- first level diagnosis - First level diagnosis is presented as Problems/ symptoms
- link registration records between both sites (Bwaila & KCH & link with general patient registration at KCH)
- recording patient in/ patient out (in wards)

- link identity of new born child with mother
- recording vitals
- basic reporting module: patient registration, # patients/day, # of babies born,...

STAGE II (during second 6 months)

- protocol based diagnosis (helps the nurse to make the right diagnosis, recording general antenatal questions, like # of children, last period,...) - Comprises of :
General Maternal encounter
Surgical maternal encounter
- secondary working diagnosis (e.g pregnancy complications, abdominal pain & high blood pressure,...)

STAGE III

- all of patient records
 - link to lab-tests
 - HTC- results
 - link to Lighthouse/MPC
 - ...
4. We recommend that all the hardware is installed in one go (economy of scale in installation and purchase) and that the software will be developed over time in stages, answering the highest needs of information first.
 5. We strongly recommend to also foresee in ongoing funding for the support of the system. e.g. like any computer system, it will need IT support, the printers need labels and ink, etc. It is crucial that this ongoing support is foreseen for a number of years, until the hospitals will be able to carry the costs themselves.

The Cost Estimate:

The attached cost estimate is for reference only to give an idea of the overall cost for installing the system. Please note that installing the system hardware is of course the most expensive part of it, together with development of the software packages. As much as possible we will be using existing modules used at other sites and only adapt where necessary to the needs of the maternity ward.

The cost-estimate is divided in 3 parts:

1. Hardware: the actual screens, and all cables, plugs, connectors, battery set, printers, label-scanners etc.

KCH, is based on 24 touch screens

Bwaila is based on 16 touch screens

2. Gives you the overhead cost for Baobab

3. Cost for software development, the installation of the system (cabling, putting the server in place, mount touch screens, train the nurses, and very time-intensive – data back entry – so that past data, can be consulted as well. We can further discuss to what length this needs to be captured.

		2009	2010
Maternity wards			
Bwaila	hardware	\$39,215	\$2,000
KCH	hardware	\$50,540	\$2,000
subtotal hardware		\$89,755	\$4,000
subtotal for overheads		39220	19282
Costs for both sites	Operations & Installation of hardware	\$28,850	\$0
	Deployment & training	\$11,444	\$1,000
	software development & project coordination	\$35,000	\$35,000
	On-going support after initial deployment	\$9,840	\$13,000
	Labels & ribbons for 1 year	\$4,000	\$4,000
	trainee allowances	\$1,300	\$300
	transport support cars + fuel	\$6,600	\$3,000
subtotal installation costs		\$97,034	\$56,300
TOTAL		\$226,009	\$79,582